# Dimensionality Dependence of Semiconductor Optical Response

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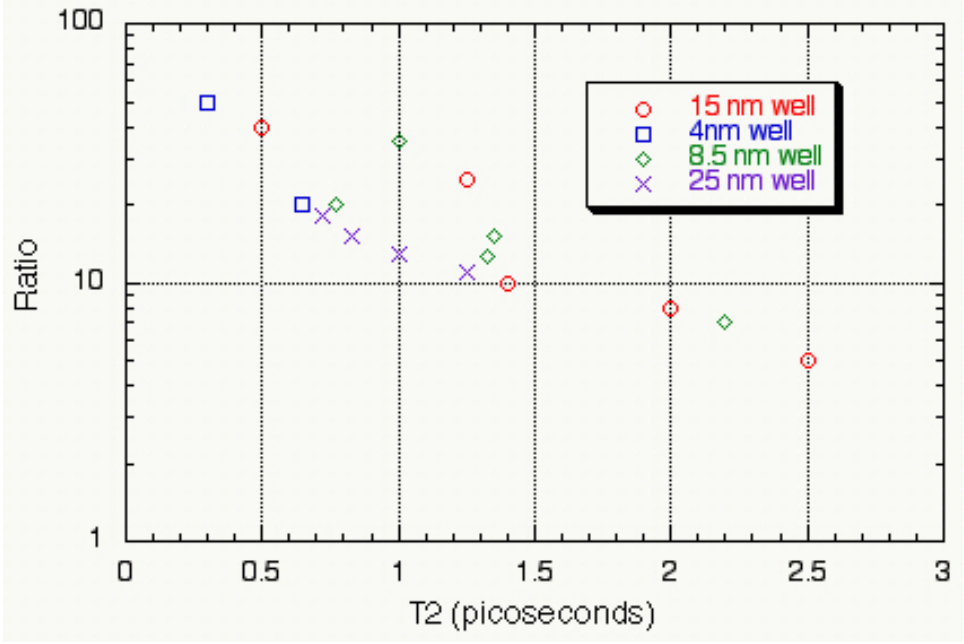


We studied fast optical response in a series of InGaAs layers of different widths. Some properties of the samples were very well-width dependent, but others (like the strength of the Coulomb interaction between excitons, shown here) were surprisingly independent of well-width.

FWM intensity at delays of +/- 500 fs

Technology is constantly pushing toward smaller and smaller electronic devices. It is often assumed that smaller devices will always be faster. But is that true? What happens to the fundamental interactions between electrons in a material as its size is reduced from the bulk (billions of atoms) to only a few atoms? We use short pulse lasers to study the fast processes in semiconductors which ultimately determine the speed limits for tiny electronic devices. In the work shown here, we have studied the way electrons interact in a set of very narrow semiconductor structures. We are looking to see which processes are slowed (or speeded) by confinement of the electrons to narrow layers. We find that some processes which were predicted to be very size dependent are, in fact, quite independent of size in our samples.

# Undergraduates trained in research in the Bolton lab at Williams College

-Research in our lab takes place as a collaboration between faculty and undergraduates only. Undergraduates are full colleagues in the work, giving presentations, designing and performing experiments, and writing papers.
-Every year 3 undergraduates have 9 weeks of full time research training in our lab, and one or two do year-long senior thesis work.
-Over the nine years of this project, more than 15 students have undertaken significant research projects with me. Of these, seven have been women and four have been students of color.
- Fourteen students trained in my lab have gone on to PhD programs in physics and engineering.